

CLAIMS

What is claimed is:

1. A compound having the formula:



wherein R_1 is selected from the group consisting of alkyl, substituted alkyl, aralkyl, substituted aralkyl, aryl, and substituted aryl; R_2 is selected from the group consisting of H, OH, or alkoxy, aralkoxy, aryloxy; R_3 is selected from the group consisting of OH, CEPA, oligonucleotide and hydroxyl blocking group; R_4 is selected from the group consisting of OH, oligonucleotide and hydroxyl blocking group; B is a nucleoside base; X is selected from the group consisting of O and CH_2 ;

wherein any alkyl portion of R_1 and R_2 is C1 to C10 linear or branched; and

wherein any aryl portion of R_1 and R_2 is a phenyl or a heterocycle.

2. The compound of claim 1, wherein R_1 is selected from the group consisting of cyanoalkyl, cyanoaryl, and cyanoaralkyl.

3. The compound of claim 1 wherein R_1 is selected from the group consisting of nitroalkyl, nitroaryl, and nitroaralkyl.

4. The compound of claim 1 in which R_1 is an amino derivative of the form X_1X_2NR , where X_1 is selected from the group consisting of H, methyl, ethyl, Ac, and CF_3CO ; X_2 is selected from the group consisting of H, methyl, ethyl, Ac, and CF_3CO ; and R is a linker that can be an alkyl, aralkyl or aryl.

5. The compound of claim 1 wherein R_1 is selected from the group consisting of hydroxyalkyl, hydroxyaryl, and hydroxyaralkyl, wherein anyl alkyl portion is C2-C8.

6. The compound of claim 1 in which R_1 is selected from the group consisting of alkoxyalkyl, alkoxyaralkyl, aryloxyalkyl, aryloxyaralkyl, aralkoxyalkyl, aralkoxyaralkyl, and aryloxy.

7. The compound of claim 1 in which R_1 is XSR, where X is selected from the group consisting of H, Ac, CF_3CO , alkyl, aryl, and aralkyl; R is a linker that can be an alkyl, aralkyl, or aryl.

8. The compound of claim 1 in which R_1 is an amide derivative of the form X_1X_2NCOR , where X_1 is H or alkyl; X_2 is H or alkyl; R is a linker that can be alkyl, aralkyl, or aryl.

9. The compound of claim 1 in which R_1 is $XOOCR$, where X is selected from H, alkyl, aralkyl, and aryl; R is a linker that can be alkyl, aralkyl, or aryl.

10. The compound of claim 1 in which R_1 is XR, where X is selected from the group consisting of F, Cl, Br, I, OTs, N_3 ; R is a linker that can be alkyl, aralkyl, or aryl.

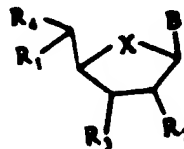
11. The compound of claim 1 in which R_1 is selected from the group consisting of alkyl, aralkyl, aryl, alkenyl, aralkenyl, where any alkyl portion is C1-C10 linear or branched, where any alkenyl portion is C2-C10 linear or branched, and where any aryl portion is a phenyl or a heterocycle.

12. The compound of claim 1 in which R_1 is selected from the

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group consisting of CN, NO₂, N₃, and CF₃.

13. A compound having the formula:



wherein R₁ is selected from the group consisting of H, alkyl, substituted alkyl, aralkyl, substituted aralkyl, aryl, substituted aryl; R₂ is selected from the group consisting of H, hydroxyl, alkoxy, aralkoxy, and aryloxy; R₃ is selected from the group OH, oligonucleotide and CEPA; R₄ is selected from the group consisting of OH, oligonucleotide and DMTrO; B is a nucleoside base; X is selected from the group consisting of O, and CH₂;

wherein any alkyl portion of R₁ and R₂ is C1-C8 linear or branched, and any aryl portion of R₁ and R₂ is a phenyl or heterocycle; and

wherein the carbon attached to both R₁ and R₂ has either R or S configuration.

14. The compound of claim 13, wherein R₁ is selected from the group consisting of cyanoalkyl, cyanoaryl, and cyanoaralkyl.

15. The compound of claim 13 wherein R₁ is selected from the group consisting of nitroalkyl, nitroaryl, and nitroaralkyl.

16. The compound of claim 13 in which R₁ is an amino derivative of the form X₁X₂NR, where X₁ is selected from the group consisting of H, methyl, ethyl, Ac, and CF₃CO; X₂ is selected from the group consisting of H, methyl, ethyl, Ac, and CF₃CO; and R is a linker that can be an alkyl, aralkyl or aryl.

17. The compound of claim 13 wherein R₁ is selected from the

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group consisting of hydroxyalkyl, hydroxyaryl, and hydroxyaralkyl, wherein any alkyl portion is C1-C8.

5 18. The compound of claim 13 in which R_1 is selected from the group consisting of alkoxyalkyl, alkoxyaralkyl, aryloxyalkyl, aryloxyaralkyl, aralkoxyalkyl, aralkoxyaralkyl, and aryloxy.

10 19. The compound of claim 13 in which R_1 is XSR, where X is selected from the group consisting of H, Ac, CF_3CO , alkyl, aryl, and aralkyl; R is a linker that can be an alkyl, aralkyl, or aryl.

15 20. The compound of claim 13 in which R_1 is an amide derivative of the form X_1X_2NCOR , where X_1 is H or alkyl; X_2 is H or alkyl; R is a linker that can be alkyl, aralkyl, or aryl.

20 21. The compound of claim 13 in which R_1 is $XOOCR$, where X is selected from H, alkyl, aralkyl, and aryl; R is a linker that can be alkyl, aralkyl, or aryl.

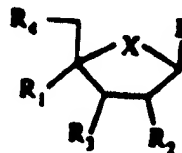
25 22. The compound of claim 13 in which R_1 is XR, where X is selected from the group consisting of F, Cl, Br, I, OTs, N_3 ; R is a linker that can be alkyl, aralkyl, or aryl.

30 23. The compound of claim 13 in which R_1 is selected from the group consisting of alkyl, aralkyl, aryl, alkenyl, aralkenyl, where any alkyl portion is C2-C10 linear or branched, where any alkenyl portion is C2-C10 linear or branched, and where any aryl portion is a phenyl or a heterocycle.

24. The compound of claim 13 in which R_1 is selected from the group consisting of CN, NO_2 , N_3 , and CF_3 .

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25. A compound having the formula:



5 where R_1 is selected from the group consisting of H, alkyl, substituted alkyl, aralkyl, substituted aralkyl, aryl, substituted aryl; R_2 is selected from the group consisting of H, hydroxyl, alkoxy, aralkoxy, and aryloxy; R_3 is selected from the group consisting of OH, oligonucleotide and CEPA; R_4 is
10 selected from the group consisting of OH, oligonucleotide and DMTrO; B is a nucleoside base; X is selected from the group consisting of O and CH_2 ;

15 wherein any alkyl portion of R_1 and R_2 is C1-C8 linear or branched, and any aryl portion of R_1 and R_2 is a phenyl or heterocycle.

26. The compound of claim 25, wherein R_1 is selected from the group consisting of cyanoalkyl, cyanoaryl, and cyanoaralkyl.

20 27. The compound of claim 25 wherein R_1 is selected from the group consisting of nitroalkyl, nitroaryl, and nitroaralkyl.

25 28. The compound of claim 25 in which R_1 is an amino derivative of the form $X_1X_2\text{NR}$, where X_1 is selected from the group consisting of H, methyl, ethyl, Ac, and CF_3CO ; X_2 is selected from the group consisting of H, methyl, ethyl, Ac, and CF_3CO ; and R is a linker that can be an alkyl, aralkyl or aryl.

30 29. The compound of claim 25 wherein R_1 is selected from the group consisting of hydroxyalkyl, hydroxyaryl, and hydroxyaralkyl, wherein any alkyl portion is C2-C8.

30. The compound of claim 25 in which R_1 is selected from the

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group consisting of alkoxyalkyl, alkoxyraralkyl, aryloxyalkyl, aryloxyaralkyl, aralkoxyalkyl, aralkoxyaralkyl, and aryloxy.

31. The compound of claim 25 in which R_1 is XSR, where X is selected from the group consisting of H, Ac, CF_3CO , alkyl, aryl, and aralkyl; R is a linker that can be an alkyl, aralkyl, or aryl.

32. The compound of claim 25 in which R_1 is an amide derivative of the form X_1X_2NCOR , where X_1 is H or alkyl; X_2 is H or alkyl; R is a linker that can be alkyl, aralkyl, or aryl.

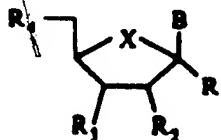
33. The compound of claim 25 in which R_1 is $XOOCR$, where X is selected from H, alkyl, aralkyl, and aryl; R is a linker that can be alkyl, aralkyl, or aryl.

34. The compound of claim 25 in which R_1 is XR, where X is selected from the group consisting of F, Cl, Br, I, OTs, N_3 ; R is a linker that can be alkyl, aralkyl, or aryl.

35. The compound of claim 25 in which R_1 is selected from the group consisting of alkyl, aralkyl, aryl, alkenyl, aralkenyl, where any alkyl portion is C1-C10 linear or branched, where any alkenyl portion is C2-C10 linear or branched, and where any aryl portion is a phenyl or a heterocycle.

36. The compound of claim 25 in which R_1 is selected from the group consisting of NO_2 and CF_3 .

37. A compound have the formula:



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where R_1 is selected from the group consisting of H, alkyl, substituted alkyl, aralkyl, substituted aralkyl, aryl, substituted aryl; R_2 is selected from the group consisting of H, hydroxyl, alkoxy, aralkoxy, and aryloxy; R_3 is selected from the group consisting of OH, oligonucleotide and CEPA; R_4 is selected from the group consisting of OH, oligonucleotide and DMTrO; B is a nucleoside base; X is selected from the group consisting of O and CH_2 ;

wherein any alkyl portion of R_1 and R_2 is C1-C8 linear or branched, and any aryl portion of R_1 and R_2 is a phenyl or heterocycle.

38. The compound of claim 37, wherein R_1 is selected from the group consisting of cyanoalkyl, cyanoaryl, and cyanoaralkyl.

39. The compound of claim 37 wherein R_1 is selected from the group consisting of nitroalkyl, nitroaryl, and nitroaralkyl.

40. The compound of claim 37 in which R_1 is an amino derivative of the form X_1X_2NR , where X_1 is selected from the group consisting of H, methyl, ethyl, Ac, and CF_3CO ; X_2 is selected from the group consisting of H, methyl, ethyl, Ac, and CF_3CO ; and R is a linker that can be an alkyl, aralkyl or aryl.

41. The compound of claim 37 wherein R_1 is selected from the group consisting of hydroxyalkyl, hydroxyaryl, and hydroxyaralkyl, wherein any alkyl portion is C2-C8.

42. The compound of claim 37 in which R_1 is selected from the group consisting of alkoxyalkyl, alkoxyaralkyl, aryloxyalkyl, aryloxyaralkyl, aralkoxyalkyl, aralkoxyaralkyl, and aryloxy.

43. The compound of claim 37 in which R_1 is XSR, where X is

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selected from the group consisting of H, Ac, CF_3CO , alkyl, aryl, and aralkyl; R is a linker that can be an alkyl, aralkyl, or aryl.

5 44. The compound of claim 37 in which R_1 is an amide derivative of the form $\text{X}_1\text{X}_2\text{NCOR}$, where X_1 is H or alkyl; X_2 is H or alkyl; R is a linker that can be alkyl, aralkyl, or aryl.

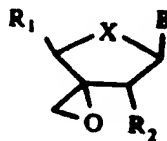
10 45. The compound of claim 37 in which R_1 is XOOCR , where X is selected from H, alkyl, aralkyl, and aryl; R is a linker that can be alkyl, aralkyl, or aryl.

15 46. The compound of claim 37 in which R_1 is XR , where X is selected from the group consisting of F, Cl, Br, I, OTs, N_3 ; R is a linker that can be alkyl, aralkyl, or aryl.

20 47. The compound of claim 37 in which R_1 is selected from the group consisting of alkyl, aralkyl, aryl, alkenyl, aralkenyl, where any alkyl portion is C1-C10 linear or branched, where any alkenyl portion is C2-C10 linear or branched, and where any aryl portion is a phenyl or a heterocycle.

25 48. The compound of claim 37 in which R_1 is selected from the group consisting of NO_2 , N_3 , and CF_3 .

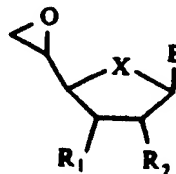
49. A compound having formula:



30 where R_1 and R_2 are each selected from the group consisting of CH_2OH , CH_2ODMTr , CHO , COOH , COOEt ; X is selected from the group consisting of O and CH_2 ; and B is a nucleoside base; wherein the tertiary carbon of the epoxy group has either R or S

configuration.

50. A compound having formula:



where R₁ and R₂ are each selected from the group consisting of CH₂OH, CH₂ODMTr, CHO, COOH, COOEt; X is selected from the group consisting of O and CH₂; and B is a nucleoside base; wherein the tertiary carbon of the epoxy group has either R or S configuration.

51. A polynucleotide comprising at least 2 nucleotide subunits, wherein at least one nucleotide subunit is a compound according to claim 1.

52. A polynucleotide comprising at least 2 nucleotide subunits, wherein at least one nucleotide subunit is a compound according to claim 13.

53. A polynucleotide comprising at least 2 nucleotide subunits, wherein at least one nucleotide subunit is a compound according to claim 25.

54. A polynucleotide comprising at least 2 nucleotide subunits, wherein at least one nucleotide subunit is a compound according to claim 37.

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